

REMARKS

Applicants appreciate the continued examination as evidenced by the Third Non-Final Office Action dated May 5, 2008 (the "Third Non-Final Action").

Claims 28, 30 and 31 stand rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Publication No. 2004/0157441 to Inoue et al. ("Inoue"). Claims 29 and 32 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Inoue in view of U.S. Patent No. 6,182,500 to Stokes et al. ("Stokes") or U.S. Publication No. 2004/0005774 to Toyoda et al. ("Toyoda"). Claims 33-36 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Inoue in view of Stokes.

Reconsideration is respectfully requested for at least the reasons that follow.

I. Claims 28-32

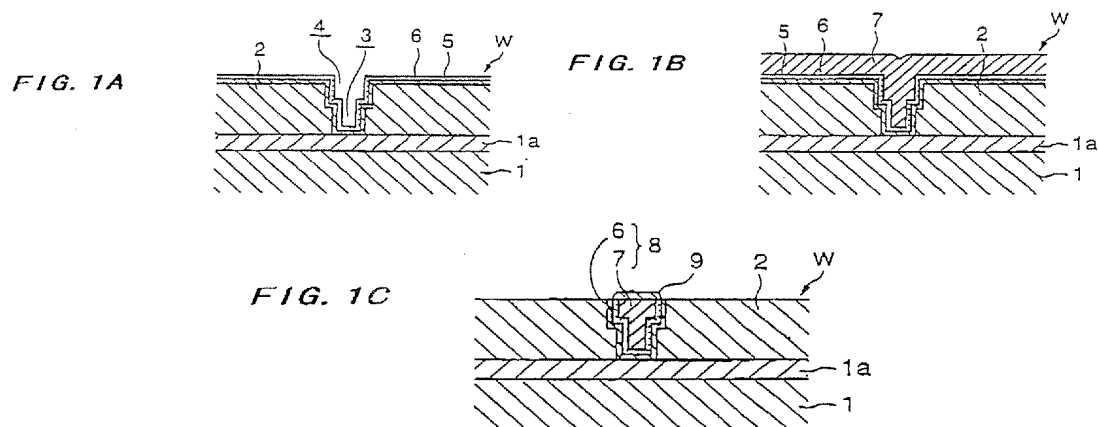
Claim 28 recites a conductive structure including:

- a first conductor;
- a plurality of atomic layers of a second conductor directly on the first conductor; and
- a first solid material directly on the plurality of atomic layers of the second conductor, remote from the first conductor, the first material being penetrable by the plurality of atomic layers of the second conductor relative to at least a second material other than the second conductor.

In Applicants' paper submitted January 18, 2008, Applicants pointed out that U.S. Publication No. 2005/0124154 to Park et al. ("Park") (which was cited in the Second Non-Final Office Action dated October 18, 2008 as allegedly anticipating Claim 28) failed to disclose or render obvious that "the first material is penetrable by the plurality of atomic layers of the second conductor relative to at least a second material other than the second conductor" as recited in Claim 28. In response to Applicants' paper submitted January 18, 2008, the rejections based on Park are now withdrawn. However, the Third Non-Final Action merely cites Inoue, which like Park, also does not disclose or render obvious the above-emphasized recitations of Claim 28 for at least the reasons that follow. Thus, if the current rejections are maintained (or if any new rejections are issued), Applicants respectfully request that the portion of any cited art that is alleged to disclose that "the first material is penetrable by the plurality of atomic layers of the second conductor relative to at least

a second material other than the second conductor" be specifically identified in any subsequent Action.

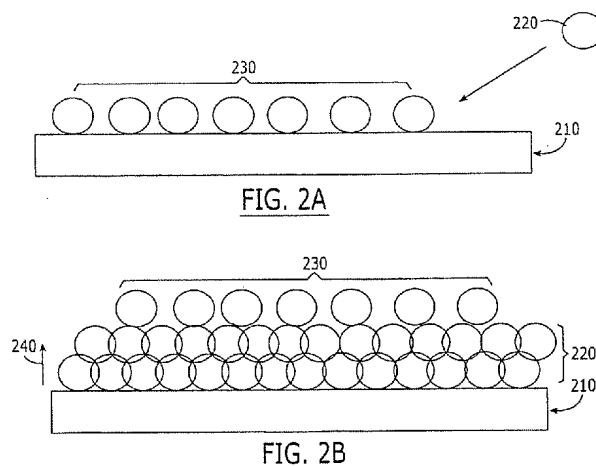
With respect to Inoue, the Action takes the position that the layers **5**, **6/7** and **9** are analogous to the first conductor, the plurality of atomic layers of the second conductor, and the first material directly on the plurality of atomic layers, respectively, as recited in Claim 28. The Action states that the first material being penetrable by the plurality of atomic layers of the second conductor relative to at least a second material other than the second conductor is disclosed in paragraphs [0045-0046], [0053] and [0087-0091] of Inoue. *See* the Third Non-Final Action page 3; Inoue, **Figures 1A-1C** (reproduced below).



As can be seen in **Figures 1A-1C**, the deposition processes discussed in the cited portions of Inoue do not disclose that the layer **9** (which the Action identifies as analogous to the first material) is penetrable by the layer **6/7** (which the Action identifies as analogous to the plurality of atomic layers of a second conductor). In particular, the layer **9** is merely deposited on the layer **6/7** as shown in **Figures 1A-1C** and as discussed in paragraphs [0045-0046], [0053] and [0087-0091] of Inoue (cited in the Action).

Accordingly, Inoue does not disclose or render obvious that "the first material is penetrable by the plurality of atomic layers of the second conductor relative to at least a second material other than the second conductor" as recited in Claim 28. For example, as shown in **Figure 2A** of the Specification and as discussed in Applicants' paper of January 18, 2008, a first material **230** is penetrable by a second conductor **220** relative to at least a second material other than the second conductor **220**,

provided on a first conductor **210**. As shown in **Figure 2B**, a plurality of atomic layers **220'** of the second conductor **220** is deposited on the first conductor **210** having the first material **230** thereon, such that the first material **230** is displaced through the plurality of atomic layers **220'** of the second conductor **220** during the depositing, as shown by arrow **240**, to provide the first material **230** on the plurality of atomic layers **220'** of the second conductor **220**, remote from the first layer **210**. **Figures 2A-2B** are reproduced below.



In addition, Applicants submit that the layers 6/7 of Inoue are not a plurality of atomic layers as maintained on page 3 of the Action because the layers in Inoue are deposited using electroless-plating liquid (*see, e.g.,* Abstract).

The above deficiencies of Inoue are not cured by Stokes or Toyoda, which are cited in the Action with respect to the recitations of Claims 29 and 32.

For at least the above reasons, Applicants submit that Inoue does not disclose or render obvious the recitations of Claim 28. Claims 29-32 are patentable at least as depending from patentable Claim 28. Applicants respectfully request that the rejections of Claims 28-32 be withdrawn.

In addition, at least certain dependent claims are separately patentable for the reasons that follow.

III. Claims 33-36

Claim 33 recites a conductive structure including:

a first layer comprising ruthenium;

a second layer comprising a plurality of atomic layers of copper directly on the first layer comprising ruthenium; and
a third layer comprising iodine directly on the second layer comprising a plurality of atomic layers of copper, remote from the first layer comprising ruthenium.

Applicants submit that Inoue and Stokes do not disclose or render obvious various recitations of Claim 33 for at least the reasons that follow.

As recently stated by the United States Supreme Court in *KSR Int'l Co. v. Teleflex Inc.*, "rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 1, 14 (2007) (citing *In re Kahn*, 441 F. 3d 977, 988 (CA Fed. 2006)). A patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. *Id.* at 15. It is improper to combine references where the references teach away from their combination. *In re Grasselli*, 713 F.2d 731, 743, 218 USPQ 769, 779 (Fed. Cir. 1983); M.P.E.P. § 2146. Moreover, when a §103 rejection is based upon a modification of a reference that destroys the intent, purpose or function of the invention disclosed in the primary reference, such a proposed modification is not proper and the prima facie case of obviousness cannot properly be made. *In re Gordon*, 733 F.2d 900, 221 U.S.P.Q. 1125 (Fed. Cir. 1984).

The Action concedes that Inoue fails to disclose that the first material (which the Action alleges is analogous to the layer 9) comprises iodine. The Action states that Stokes proposes a structure having a copper surface 30 and a protective capping layer 40 that includes iodine and concludes that it would have been obvious to combine the semiconductor device of Inoue with the iodine capping layer 40 of Stokes.

Inoue proposes that the protective film 9 (which the Action alleges is analogous to the third layer comprising iodine) is formed of a Co-B alloy, a Co-W-B alloy, a Co-Mo-B alloy or a Co-Mo-W-B alloy. *See* Inoue, paragraph [0045]. Inoue further discusses that the alloy of the film 9 "has a low resistivity (ρ)" so that an "increase in a dielectric constant of an interlevel dielectric of a semiconductor device

having an embedded interconnect structure can be suppressed." *See* Inoue, paragraph [0046]. Inoue identifies copper as an example of a low-resistance material. *See Id.*

Stokes proposes gas sensor that has a protective layer **40** that improves the sensor's sensitivity by allowing only certain gases to pass through and interact with a catalytic metal gate layer **30**. *See* col. 6, lines 14-16. Stokes discusses that the protective layer **40** can be a layer of iodine atom. *See* col. 6, lines 25-27. However, in contrast to the clear requirement of Inoue that the film **9** be made of a material having a low resistivity (ρ) to suppress the increase in dielectric constant, Applicants submit that the iodine layer of Stokes has a high resistivity (ρ). **Exhibit 1**¹ is attached hereto and includes a list of the relative electrical conductivity of various elements. It is noted that electrical conductivity is inversely related to electrical resistivity, and thus, iodine is clearly a material having a high resistivity (ρ).

Therefore, forming the film **9** of Inoue from a material such as iodine having a high resistivity (ρ) teaches away from the copper alloys and low resistivity (ρ) materials that Inoue proposes for the film **9**. In addition, a material such as iodine having a high resistivity (ρ) would destroy the stated purpose of the copper alloys of the film **9** of Inoue, which Inoue expressly states is intended to suppress an increase in the dielectric constant. *See* Inoue, paragraph [0046].

For at least these reasons, Applicants submit that Inoue and Stokes do not disclose or render obvious the recitations of Claim 33. Claims 34-36 are patentable at least as depending from patentable Claim 33. Applicants respectfully request that the rejections of Claims 33-36 be withdrawn.

IV. Claim 32

Claim 32 depends from Claim 28 and is patentable at least per the patentability of Claim 28 as discussed in Section II above. In addition, Applicants submit that Claim 32 is separately patentable for at least the following reasons.

The Action identifies the layer **9** of Inoue as being analogous to the first material. As can be seen in **Figures 1A-1C** and as conceded on page 6 of the Action, the layer **9** is clearly not a monolayer. The Action takes the position on page 6 that

¹ Kenneth Barbalace <http://klbprouctions.com/>. Periodic Table of Elements - Sorted by Electrical Conductivity. EnvironmentalChemistry.com. 1995 - 2008. Accessed on-line: 6/17/2008 <http://EnvironmentalChemistry.com/yogi/periodic/electrical.html>

the protective layer of Stokes is a monolayer, and thus concludes that it would be obvious to combine the monolayer in Stokes with the layer 9 of Inoue.

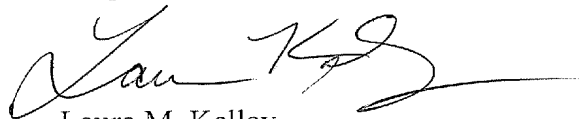
Applicants submit that there is no apparent reason to combine Stokes and Inoue for at least the reasons discussed in Section III above, *i.e.*, that there is a clear requirement of Inoue that the film 9 be made of a material having a low resistivity (ρ) to suppress the increase in dielectric constant, and the iodine protective layer of Stokes has a **high resistivity (ρ)**.

For at least these reasons, Applicants submit that Claim 32 is separately patentable and respectfully request an indication of same.

VI. Conclusion

Applicants have addressed the issues raised in the Action and respectfully request allowance of the present application for at least the reasons discussed above.

Respectfully submitted,



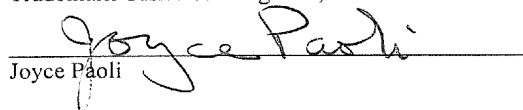
Laura M. Kelley
Registration No. 48,441
Attorney for Applicants

Customer Number 20792

Myers Bigel Sibley & Sajovec, P.A.
P.O. Box 37428
Raleigh, NC 27627
919-854-1400
919-854-1401 (Fax)

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Joyce Paoli